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(54) **MEDIA TRAY DAMPER**

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B65H 1/00 (2006.01)
B65H 31/04 (2006.01)

(52) **U.S. Cl.** **271/162**; 271/213; 211/131.2; 211/126.6; 70/38; 70/95; 70/118

(58) **Field of Classification Search** 271/347, 271/162, 213; 70/38, 95, 118, 25; 211/131.2, 211/126.6

See application file for complete search history.

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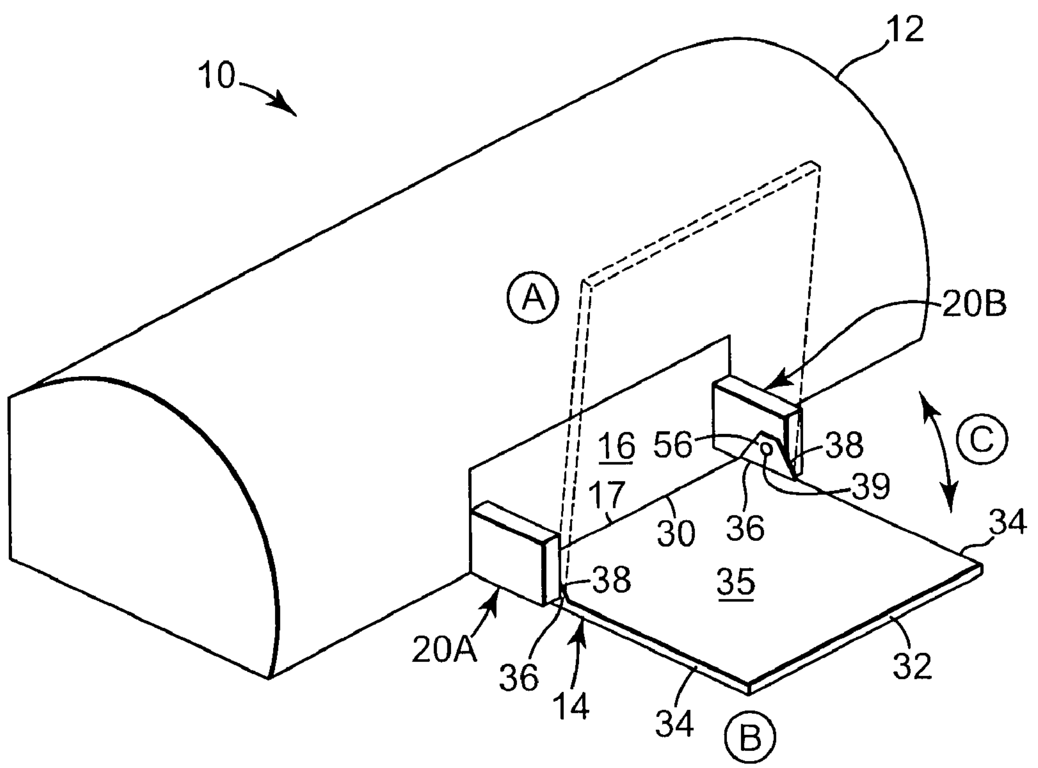
(57) **ABSTRACT**

A media handling device comprises a frame, a media tray, and a damper. The media tray is mountable to the frame for pivotal movement between a first position and a second position relative to the frame. The damper is disposed on the frame and configured for maintaining frictional engagement with the media tray.

6 Claims, 4 Drawing Sheets



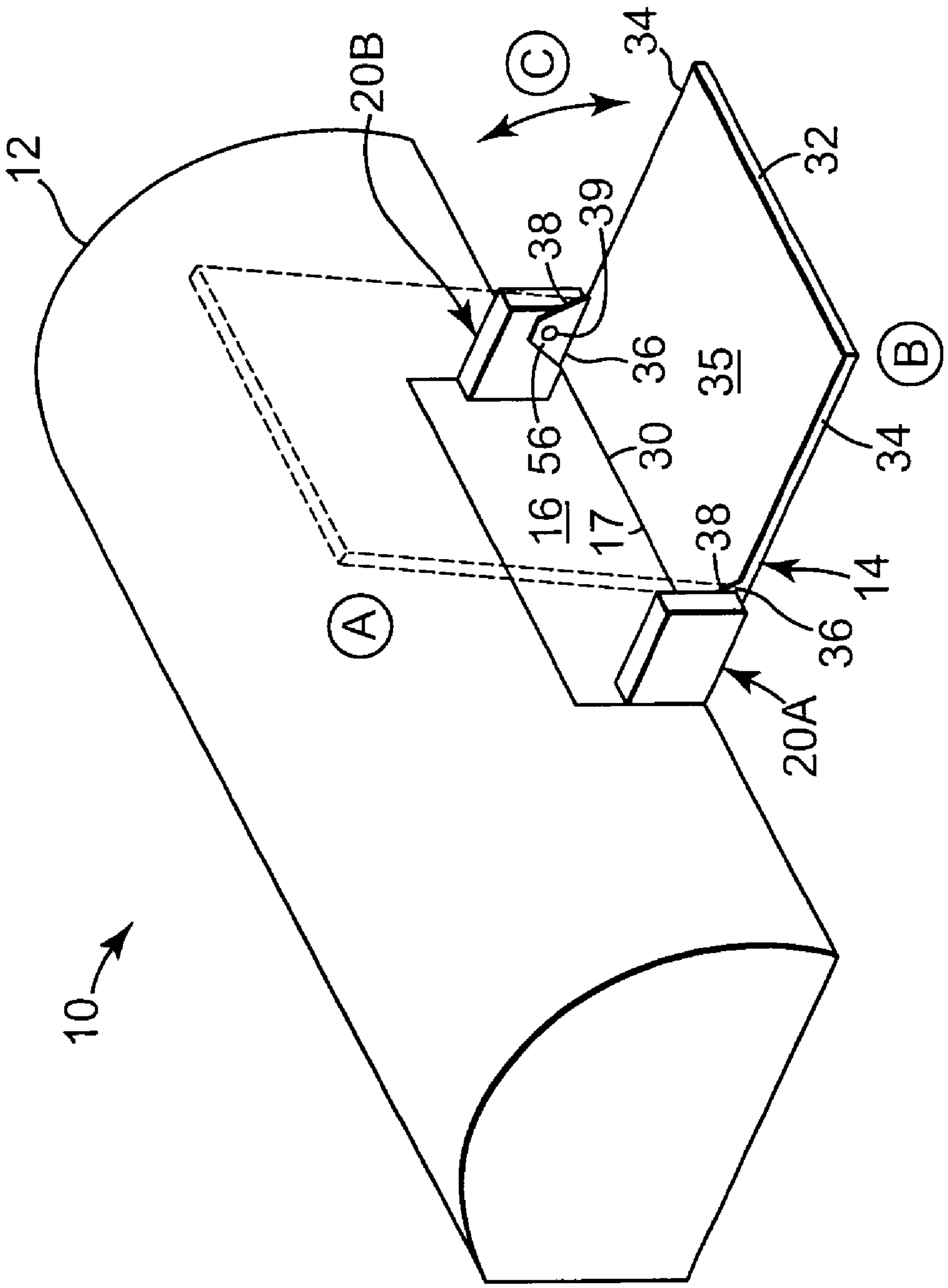


Fig. 1

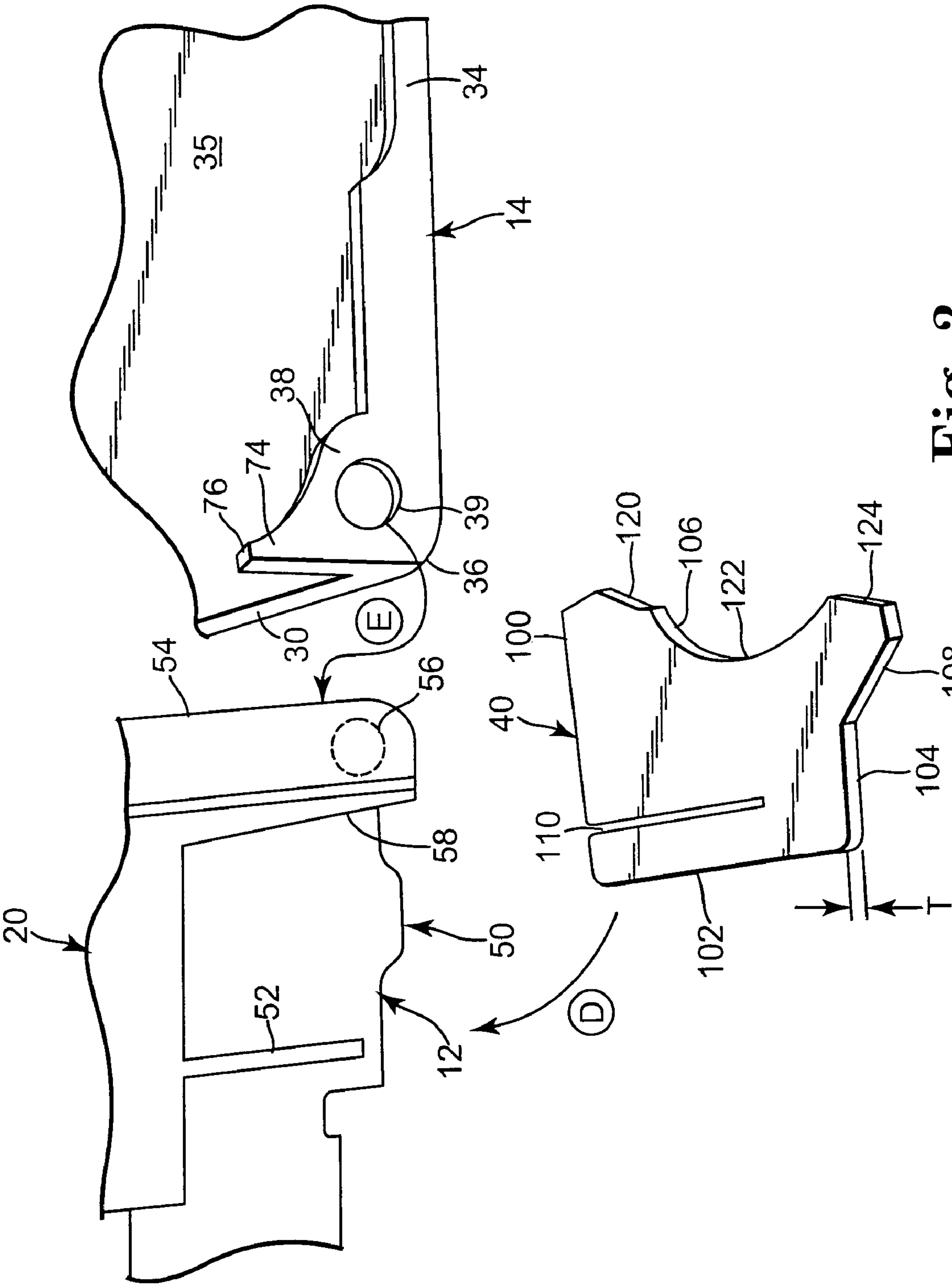


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Fig. 2

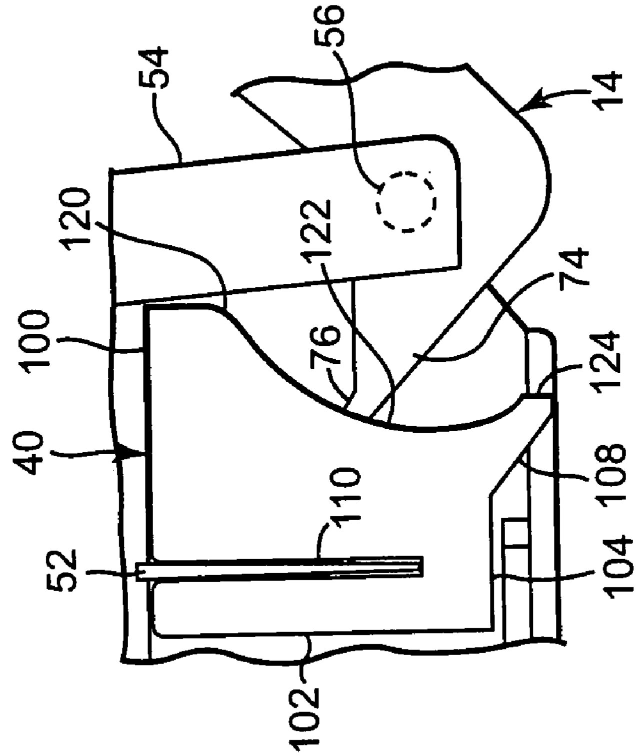
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Fig. 4

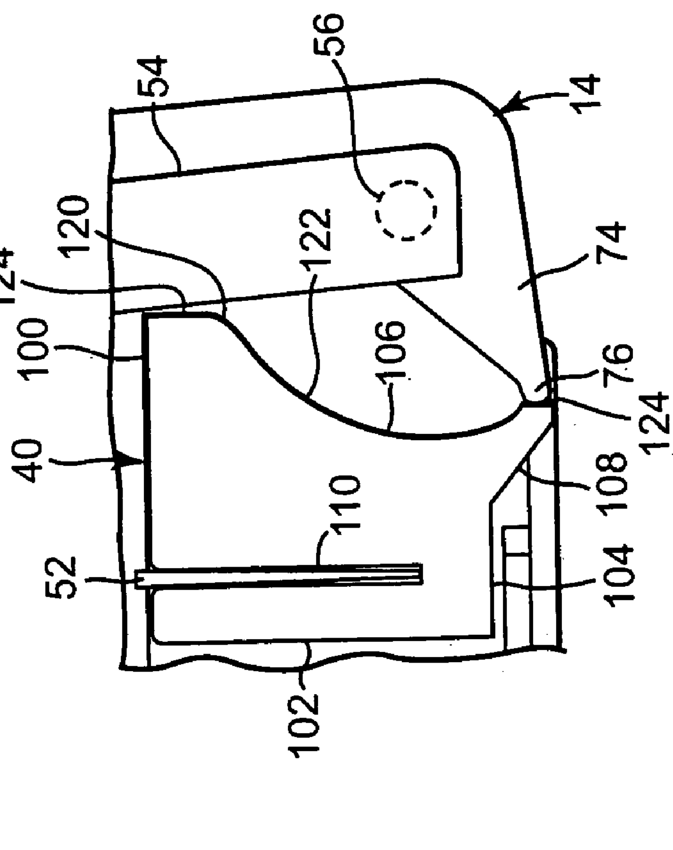
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Fig. 3

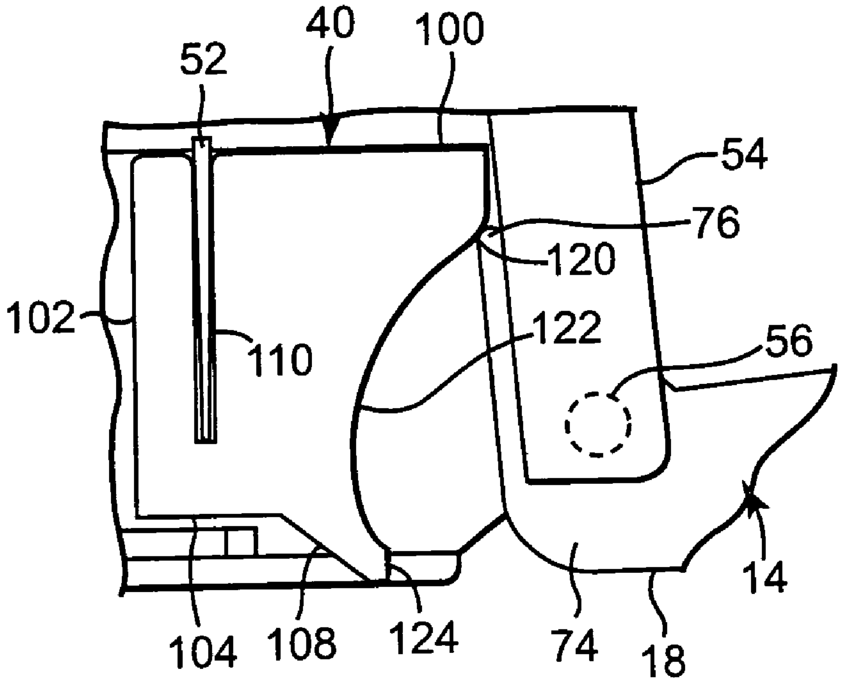
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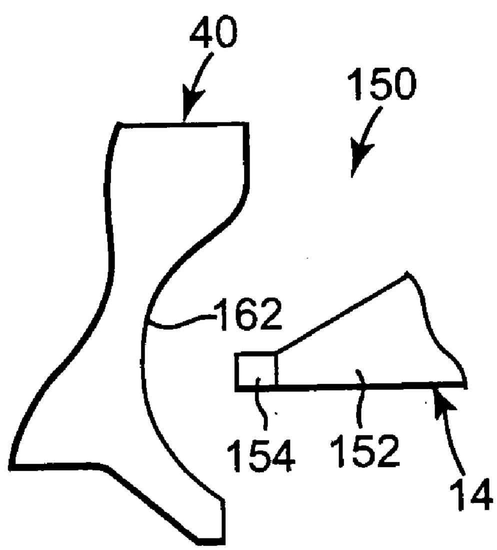
Fig. 5


40
150
162
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152
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Fig. 6

MEDIA TRAY DAMPER

BACKGROUND

Desktop printers and copiers commonly include a media tray used for receiving output or for providing media as part of a media input path. The media tray is typically rotatably mounted to the printer or copier via a conventional hinge so that the media tray is movable between an open position and a closed position. In the open position, the tray is generally horizontal to supply media or receive media. The media tray also can be pivoted upward to a closed position in which the media tray is generally perpendicular to the output path or input media path. The media tray is commonly placed in the closed position when the printer is not in use to save space on the desktop on which the printer or copier resides. Providing dampening to the media tray has been problematic in the past.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of a media handling device with a media tray, according to an embodiment of the present invention.

FIG. **2** is combination of plan and isometric views of components of a media tray, according to an embodiment of the present invention.

FIG. **3** is a side view schematically illustrating a media tray in a closed position, according to an embodiment of the present invention.

FIG. **4** is a side view schematically illustrating a media tray in an intermediate position, according to an embodiment of the present invention.

FIG. **5** is a side view schematically illustrating a media tray in an open position, according to an embodiment of the present invention.

FIG. **6** is a plan view of an alternative media tray and damper, according to an embodiment of the present invention.

DETAILED DESCRIPTION

In the following Detailed Description, reference is made to the accompanying drawings, which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. Because components of embodiments of the present invention can be positioned in a number of different orientations, the directional terminology is used for purposes of illustration and is in no way limiting. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present invention. The following Detailed Description, therefore, is not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims. All such variations are within the scope of the present invention.

One exemplary embodiment of the present invention is shown generally in FIG. **1** as media handling device **10**. Media handling device **10** comprises frame **12** and media tray **14**. As shown by directional arrow C, media tray **14** is movable between a first closed position A (shown in phantom) and a second open position B. Media handling device **10** comprises any one of various devices that handle media, such as a printer, a photocopier, a facsimile machine, a multifunction printer, etc. Media tray **14** holds various forms of media such as paper, transparencies, photos, etc.

As shown in FIG. **1**, device frame **12** further comprises inner tray **16** and first pivot housing **20**A and second pivot housing **20**B. Media tray **14** comprises inner end **30**, outer end **32**, side edges **34**, body **35**, and inner corners **36**. Each inner corner **36** includes securing portion **38** with hole **39**.

As shown in FIG. **1**, securing portion **38** of media tray **14** mounts onto device frame **12** at pivot housing **20**B via hole **39** and protrusion **56** disposed on device frame **12**. Inner end **30** of media tray **14** abuts or is adjacent edge **17** of inner tray **16** with media tray **14** extending outwardly from inner tray **16** in a generally horizontal orientation. Body **35** of media tray **14** and inner tray **16** together comprise at least a portion of a media path for media handling device **10**. Upon moving media tray **14** from open position B to closed position A, inner end **30** of media tray **14** separates from edge **17** of inner tray **16** and body **35** of media tray **14** is moved to a generally perpendicular position relative to inner tray **16**. The precise orientation of media tray **14** in the open and closed positions may vary. In some embodiments, media tray **14** may comprise a media input tray and in other embodiments media tray **14** may comprise a media output tray. Additional trays may be included with the embodiment shown in FIG. **1**, but are not shown for clarity.

FIG. **2** illustrates components of device frame **12** and media tray **14** prior to pivotally mounting media tray **14** on device frame **12**. In particular, FIG. **2** illustrates aspects of device frame **12** and media tray **14** that are visible when pivot housings **20**A, **20**B are removed. Removal of pivot housings **20**A, **20**B reveals lower portion **50** of device frame **12**, damper **40**, and securing portion **38** of media tray **14**.

For illustrative purposes, FIG. **2** only shows components of only one side of device frame **12** and one side of media tray **14** when pivot housing **20**A is removed. However, it is understood that second pivot housing **20**B (FIG. **1**) on opposite side of device frame **12** likewise houses identical components as those shown in FIG. **2**, except oriented for the opposite side of device frame **12**.

As shown in FIG. **2**, lower frame portion **50** comprises elongate protrusion **52**, vertical arm **54**, cylindrical pivot protrusion **56**, and edge **58**. Cylindrical pivot protrusion **56** is shown in phantom to illustrate its inwardly directed orientation. Pivot protrusion **56** is sized and shaped to slidably receive and mate with hole **39** of securing portion **38** of media tray **14**, thereby permitting pivotal movement of media tray **14** relative to device frame **12**. Directional arrow E illustrates maneuvering of securing portion **38** of media tray **14** for pivotal mounting on pivot protrusion **56** of lower frame portion **50** of device frame **12**.

As further shown in FIG. **2**, media tray **14** comprises those elements previously described in association with FIG. **1** and further comprises finger **74** with tip **76** that extends from securing portion **38**. Finger tip **76** is made from a molded hard plastic, such as a high impact polystyrene (HIPS), according to an example embodiment. In some embodiments, finger **74** and the remainder of media tray **14** are made of the same material as tip **76**. Other suitable materials may be alternatively employed.

As also shown in FIG. **2**, damper **40** comprises top portion **100**, back portion **102**, bottom portion **104**, and front contact portion **106**, as well as lower arm **108**. Damper **40** also comprises slot **110**. Front contact portion **106** includes first contact surface **120**, second curved contact surface **122**, and third contact surface **124**.

Damper **40** may be made from an elastomer material such as a rubber material, flexible plastic, or thermoplastic elastomer, such as a SANTROPRENE® brand thermoplastic material. In one aspect, damper **40** has a hardness in the range of about 50–100 Shore A hardness. However, damper **40** is not strictly limited to this hardness range since other parameters such as the shape, relative smoothness, and size of contact portion **106** of damper **40** in relationship to the shape, relative smoothness, hardness, and size of finger tip **76** affect the sliding frictional engagement between finger tip **76** and damper **40**. Accordingly, as the relative hardness of damper is changed, other parameters can be adjusted to insure the desired frictional sliding engagement between finger tip **76** and damper **40**. Accordingly, damper **40** is non-fluidic, solid member (i.e. not fluid-filled) having a hardness and surface characteristics adapted to enable sliding frictional engagement against finger tip **76** of media tray **14**.

In some embodiments, damper **40** is constructed so that only contact portion **106** is made of a material that has the requisite relative hardness, shape and surface characteristics to enable the desired sliding frictional engagement against finger tip **76**, with a remaining portion of damper **40** being constructed of different materials.

To deploy damper **40** on device frame **12**, damper **40** is advanced onto device frame **12** (shown by directional arrow D) by aligning slot **110** of damper **40** with elongate protrusion **52** of lower device frame **50** and slidably advancing slot **110** onto elongate protrusion **52**. Frictional engagement between slot **110** and elongate protrusion secures damper **40** onto lower device frame **50**, as will be shown in FIGS. **3**–**5**. Securing portion **38** of media tray **14** is maneuvered adjacent to pivot protrusion **56** until securing hole **39** is slidably mounted onto pivot protrusion **56** (shown by directional arrow E), thereby enabling pivoting of media tray **14** relative to device frame **12**.

Elongate protrusion **52** of lower device frame **50** and slot **110** of damper **40** may be replaced in some embodiments with an alternative fastening mechanism of reciprocating parts (e.g., pins, holes, bolts, adhesives, etc) adapted to secure damper **40** to lower device frame **50**. Accordingly, other fastening mechanisms and mating arrangements can be used to mount damper **40** onto lower device frame **50** of device frame **12**.

FIGS. **3**–**5** are side views of media handling device **10** with pivot housing **20**A disassembled to reveal damper **40** as installed on lower frame portion **50** of device frame **12** and securing portion **38** of media tray **14** pivotally mounted to pivot protrusion **56** of device frame **12**. In this mounted position, contact portion **106** of damper **40** is in a spaced relationship to pivot protrusion **56** wherein finger **74** has a length sufficient to establish and maintain sliding contact of finger tip **76** against contact portion **106**. Moreover, once mounted on lower frame portion **50** of device frame **12**, damper **40** extends in substantially the same plane as finger **74** of media tray **14** to insure sliding frictional engagement between finger tip **76** and contact portion **106** of damper **40**.

As shown by FIGS. **2**–**3**, damper **40** is non-mechanistic, i.e. has no moving parts. Damper **40** is also independent of (i.e. separate from) the pivoting mechanism (pivot protrusion **56** of device frame **12**, hole **39** of media tray **14**) that allows media tray **14** to pivot relative to device frame **12**. Only finger **74** of media tray **14**, which does not cause pivotal movement in media tray **14**, in combination with the relative mounted positions of damper **40** interposed between media tray **14** and device frame **12** causes media tray **14** to engage damper **40** on device frame **12**.

FIGS. **3**–**5** show interaction of media tray **14** with damper **40** as media tray **14** is moved from a first closed position (shown in FIG. **3**) to a second open position (shown in FIG. **5**) with FIG. **4** illustrating sliding pivotal movement of media tray **14** relative to device frame **12** between the open and closed positions.

FIG. **3** shows media tray **14** in its first closed position relative to device frame **12**. In this position, finger tip **76** is in stationary contact with third contact surface **124** of damper **40**, which maintains media tray **14** in a vertically upright position relative to device frame **12**. The shape, size, relative hardness, and surface characteristics of third contact surface **124** of damper **40** in relation to the size, shape, relative hardness, and surface characteristics of tip **76** is sufficient to maintain media tray **14** in this position. In this position, body **35** of media tray **14** extends generally parallel to vertical member **54** of device frame **12** but generally perpendicular to inner tray **16**, which forms a paper path.

FIG. **4** shows media tray **14** in its intermediate position as it is being moved to the second open position relative to device frame **12**. In this position, finger tip **76** is in sliding contact with, and frictionally engages, second curved surface **122** of contact portion **106** of damper **40**. The shape, surface characteristics, relative hardness, and size of contact surface portion **122** relative to the shape, surface characteristics, relative hardness and size of finger tip **76** causes finger tip **76** to frictionally slide upward against second curved surface **122** at a controlled rate. This interaction permits pivotal movement of media tray **14** relative to device frame **12**. This pivotal movement is maintained by action of gravitational forces on the apparent weight of media tray **14**, which increases as outer end **32** of media tray **14** travels downward. As shown in FIG. **3**, the radius of curvature of second contact surface **122** gradually becomes greater (i.e., the curved surface is tighter) as finger tip **76** moves closer to first contact surface **120**. This increasing radius of curvature counteracts the increasing apparent force exerted by finger tip **76** as media tray **14** becomes more horizontal due to gravity. This controlled rate of sliding engagement between finger tip **76** and contact portion **106** of damper **40** imparts a controlled motion to media tray **14**, i.e. a substantially uniform velocity of the media tray, as it pivots from its first closed position to the second open position. As observed by the user, non-fluidic damper **40** causes media tray **14** to smoothly and slowly drop from its closed position to the open position, instead of quickly slamming downward as would otherwise occur in the absence of damper **40**.

To initially move media tray **14** out of its stationary closed position, an operator manually moves outer end **32** of media tray **14** outward and downward, thereby dislodging finger tip **76** from first upper contact portion **120** of damper **40** into second intermediate contact portion **122**, at which finger tip **76** can slide relative to contact portion **122** in a controlled manner.

FIG. **5** shows media tray **14** in its second open position relative to device frame **12**. In this position, finger tip **76** is in stationary contact with first contact surface **120** of damper **40**, which maintains media tray **14** in a horizontal resting position relative to device frame **12**. In this position, body **35** of media tray **14** extends generally parallel to inner paper path **16** of device frame **12**. The size, shape, relative hardness, and surface characteristics (e.g. roughness) of first contact surface **120** of damper **40** relative to the size, shape, relative hardness, and surface characteristics of finger tip **76** is sufficient to maintain media tray **14** in this position. In addition, the weight of media tray **14** is maintained in this lower horizontal open position by the effect of gravity.

Media tray **14** can readily be moved from its second, open position to the first closed position by manually lifting outer end **32** of media tray **14** upward in a pivoting motion, thereby dislodging finger tip **76** of media tray **14** from first contact surface **120** to cause finger tip **76** to slide along second contact surface **122** until finger tip **76** rests at first contact surface **120**. In this maneuver, an upward manual force must be applied at all times until media tray **14** reaches the closed position at which time the interaction of finger tip **76** relative to third contact surface **124** (previously described above) maintain media tray **14** in that position.

Finally, in an alternative aspect of media handling device **10**, the type of material comprising each of finger tip **76** of media tray **14** and contact portion **106** of damper **40** are reversed so that contact portion **106** comprises a hard plastic material and finger tip **76** comprises an elastomeric material. As shown in FIG. **6**, in this alternative system **150** media tray **14** includes finger **152** with finger tip **154** that comprises the elastomeric material and damper **40** includes contact portion **162** that comprises the hard plastic material. However, in all other respects, finger tip **154** and contact portion **162** operate substantially the same as combination of finger tip **76** of media tray **14** and contact portion **106** of damper **40**, as described in association with FIGS. **1**–**5**.

Embodiments of the present invention enable controlled motion during opening and closing of a media tray for a media handling device, such as a printer, by interposing a damper between the media tray and a frame of the media handling device. This damper introduces a sliding frictional engagement of the printer tray with the damper to impart a controlled motion during pivotal movement of the media tray relative to the frame.

While specific embodiments have been illustrated and described, herein for purposes of description of the example embodiments, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent implementations may be substituted for the specific embodiments shown and described without departing from the scope of the present invention. Those with skill in the chemical, mechanical, electromechanical, electrical, and computer arts will readily appreciate that the present invention may be implemented in a very wide variety of embodiments. This application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

What is claimed is:

1. A media handling device comprising:

a frame including a pair of first protrusions with each first protrusion disposed on opposite sides of the frame and at least one second protrusion;

a media tray mountable to the frame for pivotal movement between a first position and a second position relative to the frame, and including a finger portion protruding from an end of the media tray, wherein the finger portion is made from a thermoplastic material; and

a damper disposed on the frame and including a contact portion shaped for maintaining frictional engagement with the finger portion of the media tray, wherein at least the contact portion of the damper is made from an elastomeric material,

wherein the at least one second protrusion is configured for removably mounting the damper on the frame in a position adjacent one of the first protrusions of the frame.

2. The media handling device of claim **1** wherein the media tray comprises a pair of securing holes disposed on opposite sides of the media tray with each of the securing holes configured for pivotal mounting on each of respective first protrusions of the frame to enable the media tray for pivotal movement relative to the frame.

3. The media handling device of claim **1** wherein the damper comprises a slot configured for slidably mounting the damper on the at least one second protrusion of the frame.

4. The media handling device of claim **1** wherein the at least one second protrusion comprises a pair of second protrusions and the damper comprises a pair of dampers, with the second protrusions disposed on opposite sides of the frame adjacent each of the first protrusions and with each of the dampers mounted on the respective second protrusions.

5. A media handling device comprising:

a frame;

a media tray mountable to the frame for pivotal movement between a first position and a second position relative to the frame, and including a finger portion protruding from an end of the media tray, wherein the finger portion is made from a thermoplastic material; and

a damper disposed on the frame and including a contact portion shaped for maintaining frictional engagement with the finger portion of the media tray, wherein at least the contact portion of the damper is made from an elastomeric material and the contact portion includes:

a first contact surface configured to maintain the media tray in its second position relative to the frame;

a second contact surface having a concave surface and configured to enable the frictional engagement as sliding movement between the concave surface and the finger portion of the media tray to move the media tray between its first position and the second position; and

a third contact surface configured to maintain the media tray in its first position relative to the frame.

6. The media handling device of claim **5** wherein the second contact surface of the damper has a radius of curvature that varies to maintain a substantially uniform velocity of the media tray as its pivots between the first position and the second position; and

wherein the first contact surface and the third contact surface of the damper each comprise a flat surface that forms an obtuse angle relative to the second contact surface.

* * * * *